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MINERALOGY AND PETROGRAPHY.<sup>1</sup>

**Globular Granite in Finland.**—An occurrence of spherical granite is reported by Frosterus<sup>2</sup> from the southern and eastern portions of Borga in South Finland. In the midst of a number of knolls of red or gray microcline granite, is one in which spherical nodules are plentiful. Of the rock forming this knoll there are two varieties distinguished by the difference in size of their nodules. In one the nodules are small and consist of a light covered zone surrounded by a dark periphery composed of two or three concentric biotite shells. The kernel is a granular aggregate of oligoclase, some microcline, a little quartz, and considerable biotite toward the center. The rock enclosing the nodules is a dark gray granite in which quartz and microcline are more abundant than in the nodules. In the second variety of rock the nodules are large. Their kernels are like the small nodules described. Around these is usually a narrow band of feldspar and around this a zone of mica. The rock in which the spherules lie is a grayish red granitite.

After investigating carefully the relations of the minerals in the nodules to each other and the relations existing between the nodules themselves, the author concludes that the spherules existed as plastic bodies in the rock magma while this was still liquid. When in contact with each other the nodules are often distorted, whereas at other times they are broken across. It is believed that the mica and other more basic components first separated in the form of a shell enclosing some of the rock's magma, that afterward gave rise to the granular nucleus upon cooling. The nodules are thus looked upon as basic concretions, and since they are distributed through a few restricted areas only, they are thought to form basic "Schlieren." The author's article is well illustrated by several handsome plates.

**The Inclusions in the Basalts of the Oberlausitz.**—A further study of the granite inclusions in the basalts of Oberlausitz by Beck<sup>3</sup> adds a few items of information concerning the contact action between volcanic rocks and their included fragments. On the Hirschberg the granite inclusions in nepheline-basalt have had pro-

<sup>1</sup> Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

<sup>2</sup> *Minn. u. Petrog. Mitth.*, XIII, p. 177.

<sup>3</sup> *Minn. u. Petrog. Mitth.*, XIII, p. 231.

duced in them spinels and augite. The dyke melilite-nepheline-basalt near Kemnitz becomes porphyritic around the inclusions. Spinel and augite are again the principal new products formed in the granite, but in addition to these glass nodules containing chalcedony and tridymite are also found in the inclusions. On the basalt side of the contact nepheline is lacking and feldspar takes its place, while the olivine of the original rock is broken and corroded. Around a few of the inclusions a mineral of the hauyne group has developed. The nepheline-basalt of the Spitzberg near Paulsdorf, contains a very large number of included fragments, around which the course of the contact processes may be easily studied. Around some of them is an isotropic glass containing microlites and trichites, while one large inclusion made up of many fragments is discovered under the microscope to have its pieces cemented by glass in which are feldspar and quartz fragments, and now and then small crystals of augite forming 'crowns' around the quartzes, besides biotite, granular colorless olivine and crystals of cordierite, which are always associated with magnetite. As the distance from the inclusion increases, the quartz and feldspar gradually disappear, augite increases in quantity and olivine of the basalt type becomes prominent. The rock then differs from the normal nepheline-basalt mainly in containing feldspar and in the absence of nepheline. Of course, at a greater distance from the inclusion, the rock assumes its normal composition.

**Thermometamorphism around the Shap Granite.**—In a paper published some two years ago and abstracted in the Bulletin of the Geological Society of America<sup>4</sup>, Messrs. Harkes and Marr<sup>5</sup> discussed the interesting effects produced upon andesite and rhyolitic lavas and tufas and upon limestones and slates by the intrusion through them of a great mass of granite at Shap Fell, in the Lake District, England. The same gentlemen return<sup>6</sup> to their study in a late paper, supplementing and correcting their former statements. They find in addition to the andesites and rhyolites, sheets of basalt or of a very basic andesite, containing monoclinic and orthorhombic pyroxenes, and like the other lavas characterized by an abundance of vesicles filled with products of weathering. These have suffered contact alteration to a greater extent than have the primary constituents, though all have

<sup>4</sup>Bull. Geol. Soc. Amer., Vol. III, 1892, p. 16, cf. AMERICAN NATURALIST, 1892 p. 847.

<sup>5</sup>Quart. Jour. Geol. Soc., XLVII, 1891, p. 266.

<sup>6</sup>Quart. Jour. Geol. Soc., 1893, XLIX, p. 359.

been affected near the contact with the granite. Green hornblende, brown mica, colorless pyroxene, epidote and sphene are the most conspicuous new minerals formed. These lie in a clear, granular mosaic, which may consist of newly developed quartz and feldspar. The components of the vesicles have in most cases given rise to a mixture of hornblende and quartz, but in other cases a little calcite may remain unaltered in the center of larger vesicles, while surrounding it are usually hornblende, colorless pyroxene, quartz and epidote, and sometimes in addition, zonal garnets, sphene and a few other minerals. The feldspar found within the vesicles of metamorphosed andesites is thought by the authors to be the result of the weathering of these rocks rather than a product of contact action. In concluding their paper some interesting thoughts are suggested as to the source of the materials producing contact minerals. It is known that limestones when pure may recrystallize as marbles without the production of contact minerals, but that when impure the silica in the impurities may (and generally does) release the carbonic acid and recrystallize with the calcium as silicates. In some of the vesicles of the rocks around the Shap granite, however, the calcite has recrystallized, with the formation of silicates only around the edges of its mass, proving plainly that silica was obtained for the production of the silicates only by the calcite immediately in contact with the silicates. The conclusion is that in cases of thermometamorphism no transference of material takes place within the mass of the altered rocks except between closely adjacent points. In the production of the lime silicates studied, the interchange of lime and silica is estimated to be limited to a distance of  $\frac{1}{20}$  of an inch. Other observations indicate the correctness of this conclusion.<sup>7</sup>

**Petrographical News.**—In the Obersweiler gneiss of north Vogesen are dykes of basic rocks that Andreae and Tenne<sup>8</sup> identify as hornblende kersantites. They consist of a panidiomorphic aggregate of plagioclase, green hornblende, a little mica, quartz, apatite, etc. Other dykes of the region are quartz-melaphryes of the navite type. The quartz is undoubtedly original. Its grains are much corroded and the resorption rims around it are composed of augite and glass. The rock is interesting as the first recorded example of a dyke rock corresponding to the volcanic quartz-basalts.

The porphyritic granite of northern Lausitz contains large numbers of apatite crystals, sometimes as many as a hundred in a single

<sup>7</sup>See also *Journ. of Geol.*, Vol. I, p. 574.

<sup>8</sup>*Zeits. d. deutsch. geol. Ges.* 1892, p. 824

thin section. As large as is this number it is exceeded in sections of the basic concretions of the rock from Niedersteina. These concretions according to Hermann<sup>9</sup> are made up largely of hornblende and cordierite, and thousands of apatites, sometimes reaching 1200 in a single section. The interesting features of these apatites is not, however, their number, but their forms. In many cases they are skeleton crystals whose many branches are parallel like the teeth of a comb.

**The Hour-Glass Form of Augite.**—This well known form of augite, according to Blumrich,<sup>10</sup> is usually connected with zonal growth in the mineral, and is limited in its occurrence to the pyroxene of alkaline rich magmas. It is found not only in augite, but also in other minerals forming colored isomorphous mixtures. The hour-glass form owes its existence to the fact that different crystallographic faces in a growing mineral attract molecules of different chemical compositions, which by addition to the attracting faces build out these faces with differently colored substance. The structure is certainly not due to the filling in of the outlines of skeleton crystals, as has often been assumed. Zonal bands extend uninterruptedly through both dark and light areas in the crystals, hence the materials of both must be of the same age. The one cannot have been a later deposition than the other. Pelikan<sup>11</sup> in confirmation of Blumrich's view, calls attention to the fact that if strontium nitrate crystals be allowed to grow in certain colored solutions, they become colored in areas distributed in accordance with the faces by which the crystals are bounded. The central cores of chistolite crystals, Becke ascribes in a similar manner to the attractive influence of the end faces of the crystals upon the material added during growth.

**The Effect of Impurities in Crystallizing Solutions.**—It has long been known that the habit of crystallization assumed by a substance depends in large measure on the medium from which it crystallizes. Araganite, for instance, will separate from certain solutions, while from others calcite is precipitated. Vater<sup>12</sup> has conducted a series of experiments with calcium carbonate, allowing this substance to crystallize from various solutions under different conditions; and has reached some interesting conclusions. The ground rhombohedron

<sup>9</sup> Neues Jahrb. F. Min., etc., 1893, II, p. 52.

<sup>10</sup> Minn. u. Petrog. Mitth., XIII, p. 239.

<sup>11</sup> Ib. XIII, p. 258.

<sup>12</sup> Zeits. f. Kryst. XXI, p. 433 and XXII, p. 209.

of calcite separates from all solutions of pure carbonate in dilute carbonic acid at low temperatures. In general, under different conditions of formation, differently habited crystals are produced. Moreover, different proportions of impurity in the solution affect differently the resulting crystals, as well as the rapidity with which they grow. Contrary to the prevalent belief, however, the presence of calcium bicarbonate in a solution of the mono-carbonate exerts but little influence upon the complexity of the calcite crystals formed. The article is long, and is a thorough discussion for the subject treated.

**North Carolina Quartz Crystals.**—Gill<sup>13</sup> supplements Von Rath's study of North Carolina quartz crystals by describing some new forms and giving the results of etching spheres made from simple left-handed crystals with hydrofluoric acid and hot sodium carbonate. The conclusions of his crystallographic study are to the effect that the mean of the measurements of 38 crystals give an axial ratio  $a : c = 1 : 1.1018$ . This ratio, which is larger than usual for quartz, is ascribed to the lengthening of the  $c$  axis brought about by impurities included within the crystals. All the crystals investigated were smoky quartzes, whose axial ratio approaches that of the Swiss crystals, and is larger than that of the Riesengrunde occurrences ( $1 : 1.0996$ ). The crystallization is trapezohedral-tetartohedral, which may be best regarded as *a combination of trapezohedral hemihedrism* and hemimorphism with respect to the lateral axes. The author notes the effect of various influences upon the development of the planes observed on quartz, and closes his paper with a discussion of crystal structure. The properties of quartz are explained upon the assumption of a molecule of  $\text{SiO}_2$  in which Si is in the center of a regular tetrahedron, from whose upper and lower edges the oxygen exercises its influence.

**Two New Books.**—Hatch's mineralogy<sup>14</sup> is an elementary text book for the use of beginners in the study of minerals. The book begins with a very elementary treatment of the systems of mineralogy based in the notion of symmetry. It defines the terms made use of in describing the physical properties of minerals and ends with seventy-five pages on systematic mineralogy. The classification used is an arbitrary one—the rock-forming minerals being first discussed, then the ores, next the salts and other useful compounds and finally the

<sup>13</sup>Zeits. f. Kryst., XXII, p. 97.

<sup>14</sup>Mineralogy by F. H. Hatch, London, Whittaker & Co., 1892. Pps. viii and 224. Ills.

gems. The descriptions are clear but very brief and the illustrations in the text are well selected. The little volume is one of the best of its kind, though this is but scant praise.

Gregory's translation<sup>15</sup> of Loewinson-Lessing's Tables for the Determination of Rock-Forming Minerals, adds another to the number of books that are supposed to aid the student in the rapid determination of the most common constituents of rocks. The tables are intended to lead their user to the *name* of the mineral whose characteristics he has observed under his microscope. It is a "guide to the identification of minerals, rather than a summary of their properties." The plan made use of in the construction of the tables reminds one of the schemes familiar to the determinative botanist. Habit, color, lustre, character of double refraction, etc., serve to place the minerals in different groups, from which one whose name is sought is selected by its special characteristics. The tables appear to fill a want, but only constant use in the laboratory will prove whether or not they will assist the student to the extent hoped by the author.

**Mineralogical News.**—*Azurite* with the habit of Chessy crystals and large *cerussites* prismatic in the direction of the brachydiagonal are mentioned by Molengraff<sup>16</sup> from Willow's silver mine near Pretoria in the Transvaal. On the former the three new planes  $\frac{1}{6}P_{\infty}$ ,  $-2P_{\frac{2}{3}}$  and  $\frac{1}{3}P_{\frac{2}{3}}$  occur.

On three highly modified crystals of *phosgenite* from Monte Ponì, Sardinia Goldschmidt<sup>17</sup> has discovered the new forms  $P_{\frac{3}{2}}$  and  $3P_{\frac{3}{2}}$ . The distribution of the more common faces seems to point to a trapezohedral symmetry for the crystals, but no circularly polarizing effects could be detected in them. The axial ratio determined from the mean of the best measurements is  $a : c = 1 : 1.0888$ .

An analysis of *jarosite* from the cavities of the auriferous quartzite of the Buxton Mine, Lawrence Co., S. D., has been made by Headdon.<sup>18</sup> His results are :

| SO <sub>3</sub> | As <sub>2</sub> O <sub>5</sub> | Fe <sub>2</sub> O <sub>3</sub> | CaO | Na <sub>2</sub> O | K <sub>2</sub> O | H <sub>2</sub> O | Total   |
|-----------------|--------------------------------|--------------------------------|-----|-------------------|------------------|------------------|---------|
| 30.29           | 2.51                           | 49.28                          | .42 | 4.62              | 1.57             | 11.24            | = 99.93 |

<sup>15</sup>F. Loewinson-Lessing's: Tables for the Determination of Rock-Forming Minerals. Translated by J. W. Gregory, With a chapter in the petrological microscope. London & N. Y., MacMillan & Co., 1893. Pp. 55.

<sup>16</sup>Zeits. f. Kryst., XXII, p. 156.

<sup>17</sup>Ib., XXI, p. 321.

<sup>18</sup>Amer. Jour. Sci., XLVI, 1893, p. 24.

Three fragments of *powellite* have been obtained by Koenig and Hubbard<sup>19</sup> from the south Hecla copper mine in Houghton Co., Mich. The mineral has a density of 4.349. Its composition was found to be:

| MoO <sub>3</sub> | WO <sub>3</sub> | CaO   | MgO | Fe <sub>2</sub> O <sub>3</sub> | SiO <sub>2</sub> | Cu   | Total |
|------------------|-----------------|-------|-----|--------------------------------|------------------|------|-------|
| 67.84            | 1.65            | 27.30 | .16 | .96                            | 1.52             | tr = | 99.43 |

Native *lead* is reported by Kempton<sup>20</sup> as occurring in thin scales and pellets, some of which approach rectangular forms, in a gangue of pyroxene of a pale green color. It is associated with iron oxides and calcite. The location given is near Saric, Sonora, Mexico.

**Methods and Instruments.**—Federow<sup>21</sup> in a recent article elaborates a new universal method for the measurement of crystals, suggests a new system for crystallographic nomenclature and illustrates a new method of projecting crystal planes, and determining by graphical means their symbols. The universal goniometer used in his investigations is described at length and pictured in detail. The author illustrates also the application of his method to studies in optical crystallography. He describes two models of universal microscope stages, constructed for the purpose of enabling the observer to revolve the object under investigation in two directions. The plagioclases are studied and it is shown that the labor of determining their nature is much reduced by the method of work suggested by the author. The paper is an important one and one well worthy of close study.

Czapski<sup>22</sup> suggests the use of the iris diaphragm between a condenser of moderate strength and the stage of the microscope for the rapid interchange of parallel and converged light, and also the use of the same appliance in the ocular tube of the instrument for the isolation of the axial figures of very small crystals.

G. Friedel<sup>23</sup> gives a new method for determining the value of the double refraction in thin sections of minerals that seems to be simple in its application.

Goldschmidt<sup>24</sup> and Jolles<sup>25</sup> discuss two proposed methods for projection of crystal forms. Jolles article is illustrated by five plates and sixty figures.

<sup>19</sup>Ib., XLVI, 1893, p. 356.

<sup>20</sup>Science, June 23, 1893, p. 345.

<sup>21</sup>Zeits. f. Kryst., XXI, p. 574 and XXII, p. 229.

<sup>22</sup>Ib., XXII, p. 158.

<sup>23</sup>Bull. Soc. Min. Franc., XVI, p. 19.

<sup>24</sup>Ib., XXII, p. 20.

<sup>25</sup>Ib., XXII, p. 1.